The Scientists' Bookshelf

A Source of Basic Environmental Literacy

Living Dangerously: The Earth, Its Resources, and the Environment. Heinrich D. Holland and Ulrich Petersen. 490 pp. Princeton University Press, 1995. $49.50.

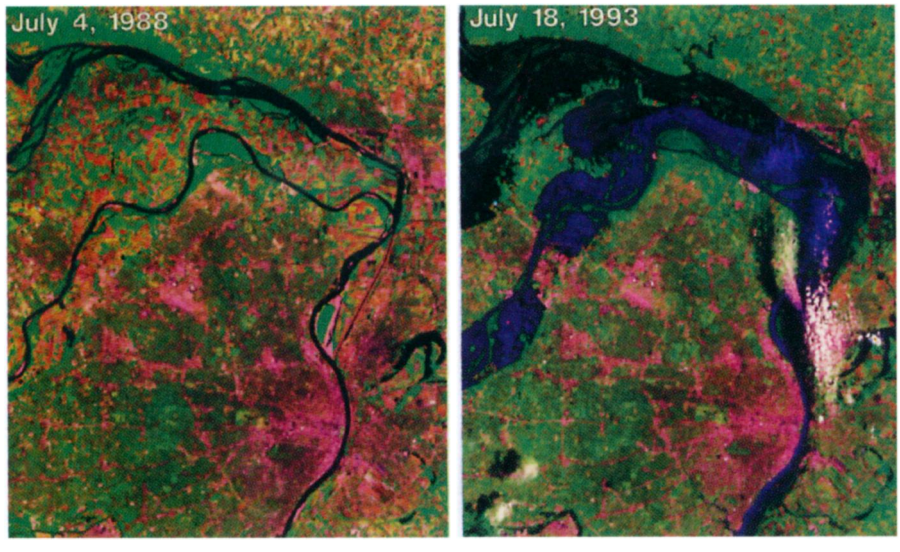
This is a book about Earth, the third planet from the Sun, and earth, the land surface of the world and home of humanity, in distinction from heaven and hell. I, along with the American Geophysical Union, the Geological Society of America and the authors of this book, use the capital letter to connote respect for a fragile and finite planet. The editors of *American Scientist* and some other publications, fewer each year, often use the lowercase letter, but all of us are talking about the geological object and the home of humankind.

About 10 years ago, Harvard University decided that all of its graduates should take a course or two in science and implemented a core curriculum. "The Earth, Its Resources, and the Environment" was one of the offerings aimed at future lawyers, doctors, poets and economists and English majors. The philosophy was that all educated persons should understand how the earth works, how renewable and nonrenewable natural resources are formed and distributed, and how humanity is transforming the planet. One could even argue that the study of earth science could be treated as a humanities course.

Learning about the history of the earth and the language of the earth are now more essential than learning about the history of the South or the language of a small country. Lawyers, planners and politicians, even home builders, need to understand their planet. Bad decisions and even tragedies result from lack of the most elementary understanding of an environment that obeys predictable natural laws: Dams tend to trap sediments, beaches come and go, 100-year floods may occur next year, landslides happen, old river channels are there for a reason and low places flood. On a more regional scale it is clear that bad or uninformed policy can affect more than a few houses or people. Easter Island, Madagascar and the Dust Bowl provide lessons that everyone should learn. More recently, the ozone hole and global warming show that the cumulative, deleterious effect of human behavior on the planet is accelerating. As a planet Earth, of course, will survive, but as a home for humankind, it may not. It is good that at least Harvard-trained politicians and economists will now understand this.

The title and subtitle and content of this book were picked with care. The book is about earth, air, water, energy and people. It is an innovative earth, natural-resource and environmental-science text based on an earth-systems science approach. As both a science book and a policy book, it is written so that the student can decide whether we are apt to run out of resources or drown in our own garbage. Only high school mathematics and chemistry are required, and minor doses of physics and biology are provided. This is *the* science course for nonscience majors, if only one is required.

It is not as strident or pessimistic as Paul Ehrlich's *The Pollution Bomb (1968)*, Albert Gore's *Earth in the Balance (1992)* or *Limits to Growth, A Report for the Club of Rome's Project on the Predicament of Mankind* (1972); nor is it as optimistic as Julian Simon and Herman Kahn's *The Resourceful Earth (1984)*, Dixy Lee Ray's *Environmental Overkill (1993)* or Ronald Bailey's *Eco-Scam (1993)*. As a science book it teaches that facts and understanding must precede opinions and policy, something both scientists and nonscientists need to appreciate. It is not a traditional geology text, nor is it in the tradition of books devoted to natural resources or environment science. It is a well-balanced book that interweaves these disciplines and interlaces them with various human needs. It is not an easy book, and nonscience majors will have to stretch to understand the graphs and formulae. Nevertheless, any college-educated person should, as a goal, be able to digest this level of material as a matter of general, not just scientific, literacy. Although the book is not alarmist, the figures and graphs show trends that may alarm the weak-hearted. It is optimistic in the sense that it demonstrates that we know what to do about most of the problems. Amelioration of the ozone hole and lead pollution, for example, are two potential



Normal (1988) and flood-stage (1993) river levels at the junction of the Mississippi, Illinois and Missouri Rivers. From *Living Dangerously*.

scientific success stories, although it may be too soon to tell. Global warming and overpopulation appear to be lost causes.

My favorite figure, given almost without comment, is entitled "The energy sources of humankind...." It shows a brief span of time, about one and a half millennia in duration, centered on 2100 A.D., in which fossil fuels are our main energy source. Prior to this epoch, energy was provided by slaves, animals and firewood. In the not too distant future, the options are slaves and animals, with at least one of these questionable, or nuclear, hydroelectric, geothermal or solar. A high level of scientific literacy is required for the second set to be viable, and this option, too, could devastate the planet if it is not handled wisely.

There are 63 color plates and about 300 figures. Informative tables are used generously. Many of the figures are from easily accessible and semipopular articles. This is appropriate for the audience, but many are out of date because more dramatic, understandable and accurate versions are now available. This is, however, a forgivable shortcoming since searching for or preparing current illustrations probably would have delayed publication of the book by several years. I would rather have the book available now and hope that future editions can slowly incorporate newer graphics.

The authors present a number of 100-year projections, which show that humanity will be living dangerously during the 21st century. The scientific basis for policy decisions is sketched out for many areas of planetary exploitation and protection. It is a sad fact that lawyers and courts and lobbyists are deciding scientific issues, and that defense departments and their political supporters are unaware of the real threats to our society and civilization. The list of dangers facing humanity during the next century is long and formidable. To the authors, none of the dangers looks insurmountable. They are cautiously optimistic and quote Hotspur:

> 'But I tell you, my lord fool,
> Out of this nettle, danger,
> We pluck this flower, safety.
> (*Henry IV*, Part 1, Act 2)

Hotspur was killed shortly thereafter by the Sheriff of York. Hotspur had cried out against evil exploitation "of the bowels of the harmless earth." It is to be hoped that our politicians will be wiser than Shakepeare's and that the authors' optimism will be rewarded, that universities other than Harvard will adopt the policy that everyone—not just a Harvard lawyer—needs to know how to think rationally and to have some science literacy. It is vital that all educated people learn enough, soon enough, about the earth. This book is a good place to start.—*Don L. Anderson, Seismological Laboratory, California Institute of Technology*

The Grizzly: Symbol of Lost Wilderness

The Grizzly Bears of Yellowstone: Their Ecology in the Yellowstone Ecosystem, 1959–1992. John J. Craighead, Jay S. Sumner, and John A. Mitchell. xxi + 535 pp. Island Press, 1995. $100.

Lions and tigers and bears—species that on the one hand instill fear, yet on the other elicit extraordinary respect and fascination. The grizzly bear is arguably the most revered species in North America, a product not only of its size and demeanor, but also of its presumed dependence on large, unfragmented wilderness, places untrammeled by man. The intrigue of the wildness symbolized by the grizzly bear was put aptly by Stephen Herrero, an eminent bear biologist from the University of Calgary: "Entering into grizzly country presents a unique opportunity—to be part of an ecosystem in which man is not necessarily the dominant species." An important question today is whether such ecosystems really exist.

Yellowstone National Park is one of only half a dozen remote, mountainous, disjunct regions in the western U.S. that still harbor grizzly bears. There is substantial controversy in the scientific community, however, as to whether Yellowstone, or any of the other sites, is large enough to sustain a viable grizzly population. This controversy can be traced back almost three decades, to the time when John and Frank Craighead were in the midst of the first intensive study of the species.

The Craigheads' work on grizzlies in Yellowstone may be one of the most well-known sagas in wildlife research. When it began in 1959, grizzlies routinely congregated at several garbage dumps within and adjacent to the park, as they had since the late 1800s. To conduct their study, the Craigheads pioneered new methods in capture, chemical immobilization, marking (for identification), age estimation (from rings in teeth) and tracking with radio-transmitter collars, which enabled bears to be located during the course of their wide travels and at remote den sites. As a result of these new methods—and the unique opportunity afforded by the dumps to watch, individually identify and accurately count bears—the Craigheads amassed prodigious quantities of data on the life history, social relationships and demographics of this population.

In 1971, their study came to a screeching halt. Yellowstone National Park hired a new superintendent and a new research biologist in the late 1960s, both of whom maintained that the dumps should be closed abruptly in order to restore the naturalness of the area. They also believed that Yellowstone contained two subpopulations of bears, one that was entirely dependent on the dumps and another that was essentially wild. The rationale was that bears that were unable to cope with closure of the dumps would be eliminated from the population, thus restoring it to its former, natural state.

The Craigheads strongly disagreed with this distinction of dump and non-dump bears and warned that rapid closure of the dumps would imperil the population. As a result of this disagreement, compounded by a serious personality clash, the park began imposing restrictions on the Craigheads' work—disallowing further marking of bears and requiring screening and approval of all oral and written statements or reports about their study—which left them no option but to terminate their research.

Although Frank Craighead published a popular account of the study and some of its major findings in 1979 (*Track of the Grizzly*, Sierra Club Books), and several technical papers—which were published by John and Frank together, separately or with other junior authors—the bulk of the data and a real synthesis of it remained unavailable until now.

John Craighead's book, which he coauthored with two of his close colleagues, Jay Sumner and John Mitchell, provides that data and synthesis. It is written for scientists. It includes more than 300 tables and figures, statistical tests, frequent cross-references, an exhaustive literature review and a thorough index. Even with all of this scientific scholarship, the writing style is not beyond the grasp of lay bear fanciers or those generally interested in wildlife. The book is filled with outstanding color and black-and-white photographs, and has detailed plate captions and concise chapter summaries for those who are not interested in *all* of the details.

One might wonder how relevant these quarter-century-old results could be. After all, studies of grizzly bears are now commonplace. In fact, more than 900 grizzlies have been radio-collared in an ongoing study in Alaska's interior. Furthermore, a recent worldwide survey indicated that more than 1,100 bears of various species are currently radio-collared. Some of these collars are so sophisticated that they have internal global positioning system (GPS)